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Mid-UV Determination of Elliptical Galaxy Abundances and Ages
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abstract We investigate the effects of abundance and age on the mid-UV spectra and Mg_2 strengths of stellar populations using simple population synthesis models. These models are used to constrain the star formation history of four nearby elliptical galaxies and spiral bulges. The mid-UV (1800 - 3200 Å) light of evolved stellar populations ($>$ 1 Gyr) is dominated by the main sequence turn-off, unlike the optical light which is dominated by the red giant branch. Because the main sequence turn-off is sensitive to age and metallicity in ways different from the RGB, a detailed investigation of the mid-UV features of elliptical galaxies may help break the age-metallicity degeneracy that plagues optical techniques. Also, a better understanding of this wavelength region is useful for the studies of $0.5 \leq z \leq 1.5$ galaxies for which the rest frame mid-UV is redshifted into the visible. We create simple, single age (3-20 Gyr), single metallicity (Z = 0.0004 - 0.05) spectral energy distributions (SEDs) extending into the UV using the Kurucz model stellar fluxes. Comparison to standard stars' mid-UV spectra reveals that the Kurucz model fluxes accurately model a blend feature of FeI and MgI at 2538 Å (Bl2538) and the slope of the continuum between 2600 and 3100 Å ($S2850$). We find that our simple single age, single metallicity SEDs agree well with these mid-UV features of globular clusters. However, the majority of the galaxies do not agree with the Bl2538, $S2850$, and Mg_2 values given by these simple models. The mid-UV features appear to require both an old metal-rich and an old metal-poor ($Z \leq 0.001$) population. The implied metal-poor population is less than 10% of the total mass for all the galaxies but dominates the SEDs shortward of 3000 Å. Intermediate age (1-5 Gyr) populations are not required to match the UV for any of the galaxies, but are not ruled out. Despite being limited by the quality of the model stellar fluxes, our study has yielded two promising mid-UV spectral diagnostics (Bl2538 and $S2850$) and suggests unique and complex star formation histories for elliptical galaxies.